NASA GSFC Containerized Computing

Code 700

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Goddard Space Flight Center – IS&T Colloquium
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Goddard SPACE FLIGHT CENTER

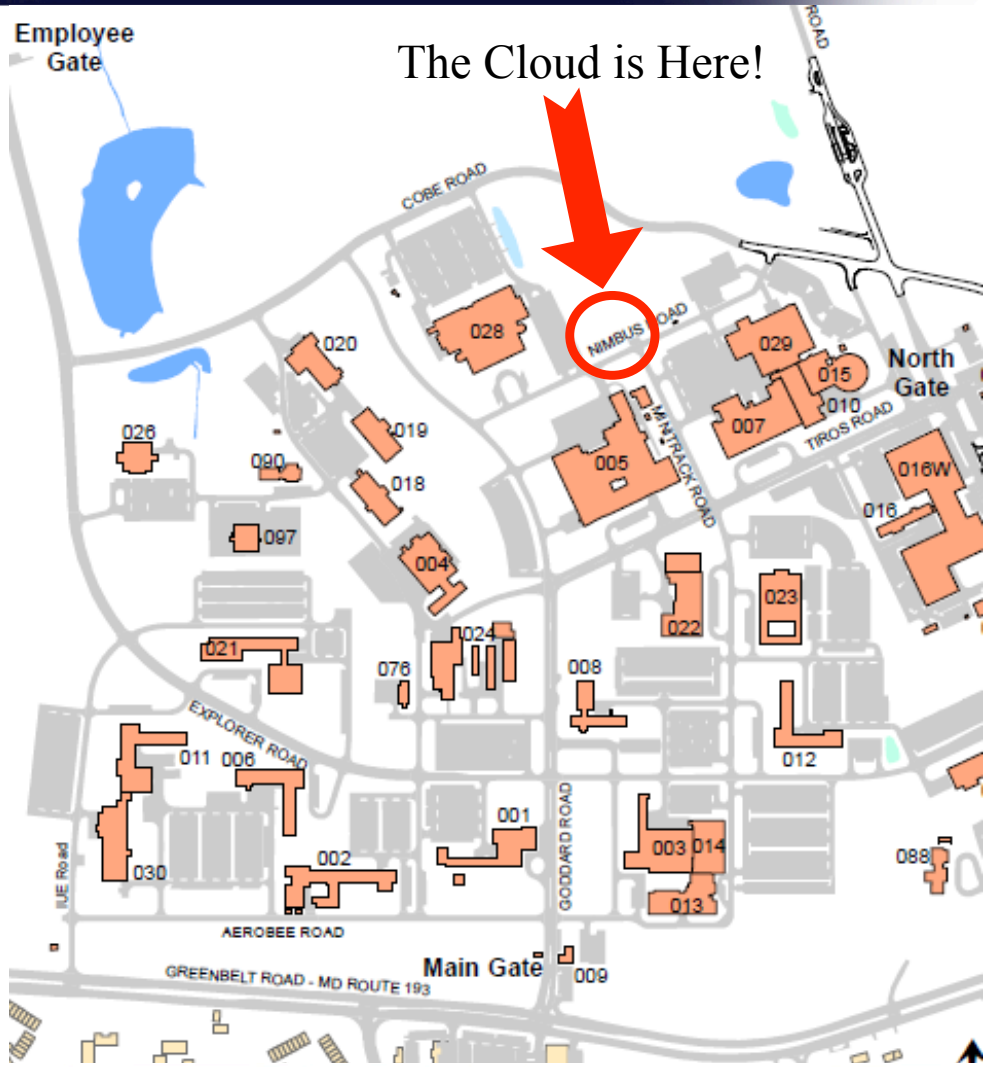
Agenda

- History
- Location
- Infrastructure
- Innovation Activities

History

- **2009 NASA Nebula Project at Ames Research Center**
  - Computing and data storage services for NASA Centers, Mission Directorates, and external customers
- **2010 OpenStack**
  - NASA and Rackspace develop open source cloud software under Apache 2.0 License
- **2010-2011 Goddard Acquires Modular Data Center – Container**
  - NASA purchases and installs 40' container at Goddard as part of its Cloud Services
- **2011-Present "Operationalizing" the Container**
  - Nebula (decommissioned 2012)
  - Innovation prototyping, cloud computing proofs-of-concepts
  - Back-up

Location

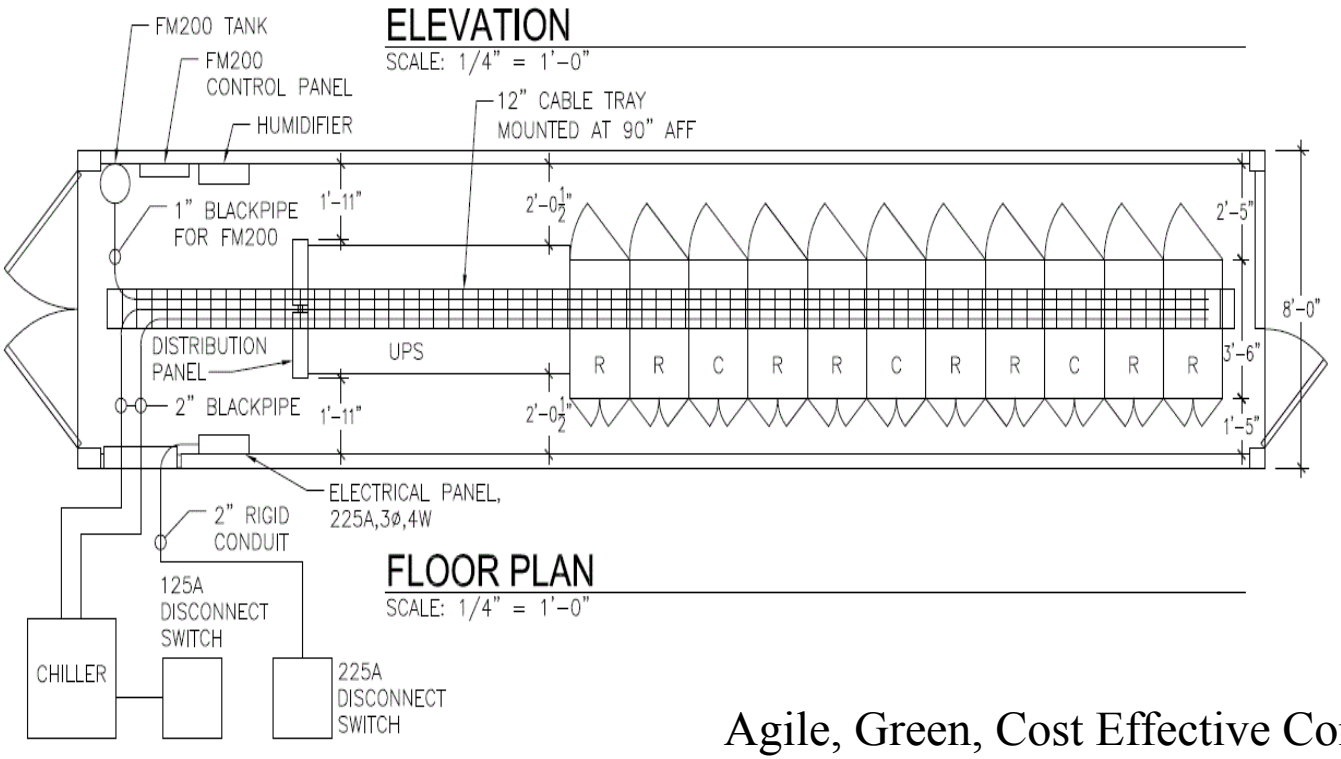


Goddard SPACE FLIGHT CENTER

Location


NASA CLOUD SERVICES
Hosted by Goddard Space Flight Center
DELL
intel
ARISTA
APC

Container Infrastructure



Agile, Green, Cost Effective Computing

- 30-50% Power savings over typical brick and mortar data centers (assuming PUE reduction from the range of 2.2 – 1.8 down to 1.2 – 1.05)
- Operational lessons learned that can benefit the Center as a whole when considering containerization as a part of data center strategy

Container Infrastructure

	RACK 1 - Code 750	RACK 2 - Innovation	RACK 3 - Code 750	RACK 4 - Code 750	RACK 5 - Code 750	RACK 6 - Innovation	RACK 7 - Code 750	RACK 8 - SEWP
Network	**CNE**	**SEN**	**CNE**	**CNE**	**CNE**	**CNE**	**CNE**	**CNE**
"Stack"	Fail-over HyperV Windows Cluster	Eucalyptus	Fail-over RHEV Linux Cluster	Fail-over stand-alone systems	Fail-over storage COOP Pilot	VMware vSphere + BMC CLM Citrix VDI	"On Hold" for SEWP system currently under development	SEWP Housing

Container Racks

Innovation Hardware/Software

ITCD Containerized Cloud Computing Hardware

- The Innovation Team's computing hardware is located within (2) nineteen-inch computer racks (racks 2 and 6):
- (2) Arista Networks 24-port Ethernet switches, (1) Juniper EX2200 48-port Ethernet switch, and (1) Dell KVM 48-port switch
- (6) Dell PowerEdge R720 Servers 128GB RAM, CPU x2 / 8 Cores 2x 146GB, 15K RPM SAS
- (1) Citrix NetScaler MPX 9700
- (1) Dell PS5000XV SAN and (1) Dell PS6100XV SAN

ITCD Innovation Team

What is the Innovation Team?

- The Code 700 Innovation Team is responsible for developing cutting edge technology solutions for use across the Goddard Space Flight Center campus.
- The Innovation Team works with clients to take a vision, conceptualize a design, and develop an emergent technology solution **in the ITCD Containerized Cloud Computing Environment.**

What is the ITCD Containerized Cloud Computing Environment?

- The Innovation Team utilizes the Containerized Cloud Computing Environment, constructed outside of Building 28 on the Goddard campus.
- The **container is a fully functional datacenter housed in a shipping container**, with independent power and cooling systems.
- Developing technologies in the container enables the Innovation Team to centralize management of hardware, software, and security.

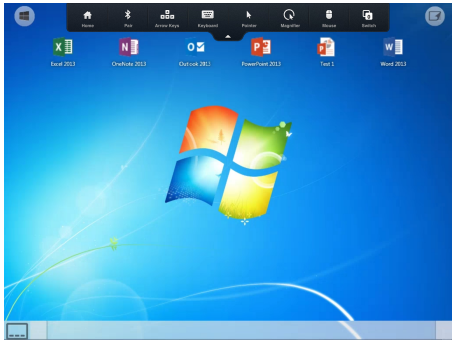
Innovation Team Prototypes

Cloud Computing - BMC Cloud Lifecycle Management

- Complies with standardized agency governance, including security requirements
- Provides a strong, flexible, and scalable cloud infrastructure
- Delivers a self-provisioning portal with chargeback capabilities

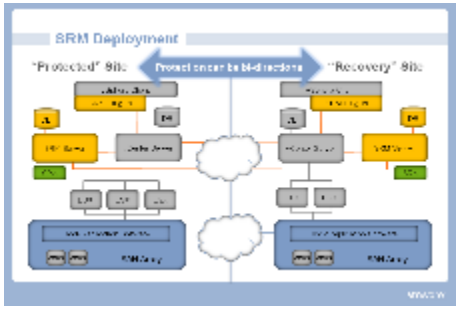
Virtual Desktop Integration (VDI)

- VDI is a remote centralized environment hosted by a data center that is capable of running desktop operating systems
- VDI reduces operations expenses by managing administrative and security tasks from a centralized location



Disaster Recovery – Site Recovery Manager *[concept]*

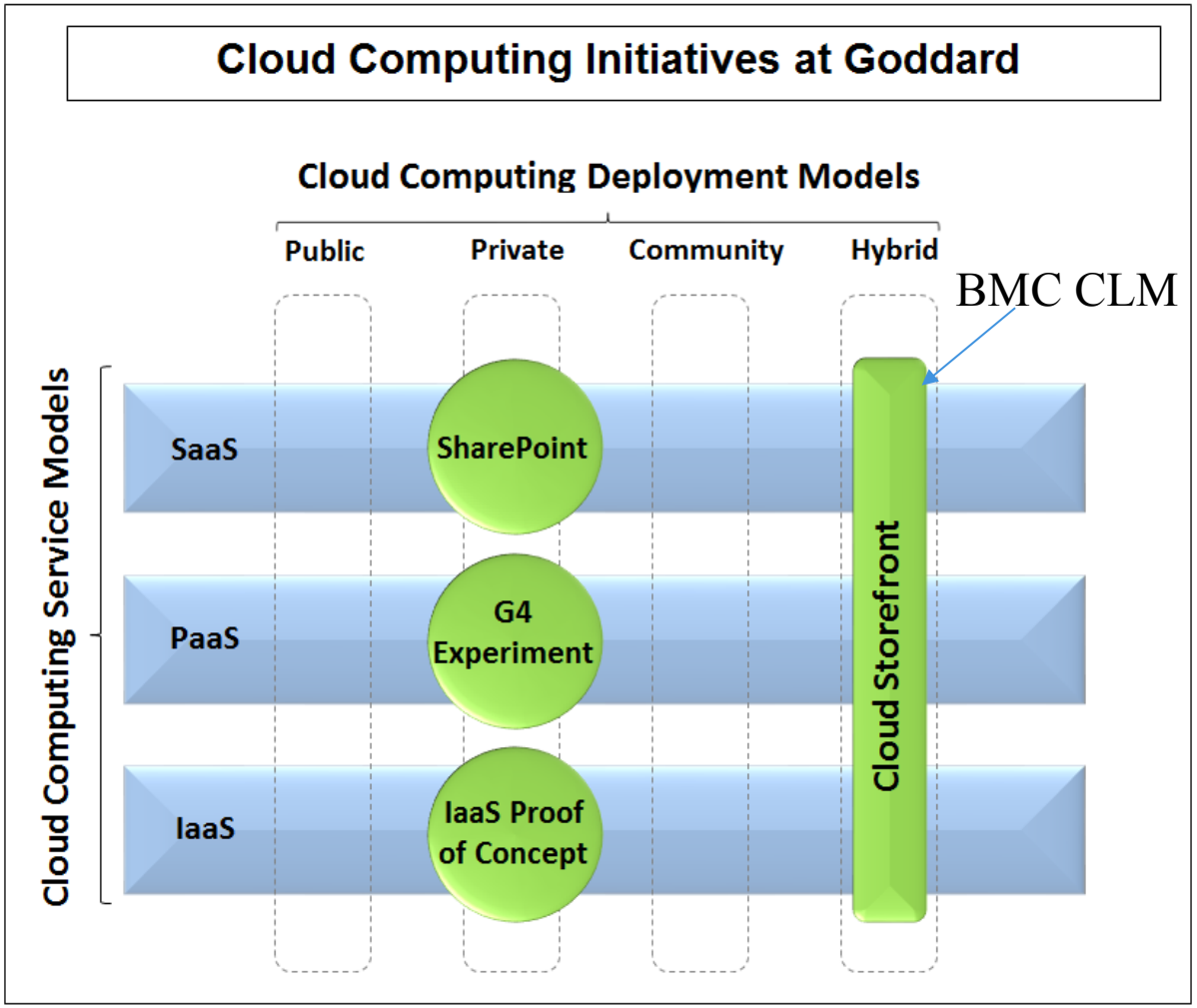
- Mitigates potential data loss by automating data replication from multiple places, including physical and virtual servers
- Automates disaster recovery failover and boot sequence
- Provides primary and alternate site data replication – foundation of a COOP strategy



Innovation Cloud Computing in the Container

SaaS—Software as a Service
PaaS—Platform as a Service
IaaS—Infrastructure as a Service

G4—Giovanni 4 (Experiment) (**G**eospatial **I**nteractive **O**nline **V**isualization **AN**d a**N**alysis **I**nfrastructure). Web-based application developed by the Goddard Earth Sciences Data and Information Services Center (GES DISC) that provides a simple and intuitive way to visualize, analyze, and access vast amounts of Earth science remote sensing data without having to download the data



Benefits of Innovation

What Innovation Can Do For You

- Leverage a highly experienced team of Project Managers, Analysts, Cloud Engineers, Technologists, and Security Engineers with deep experience in innovation projects and a wide range of technical capabilities to develop emerging technologies
- Accelerate identification of new technologies, rapid prototyping and proof-of-concept development in a dedicated (containerized) environment
- Identify technology gaps and streamline operational process to decrease business needs

Thank You!

- Contact for more information:
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- Some cool (and useful) links (GSFC intranet):

  http://itcd.gsfc.nasa.gov/

  http://itcd.gsfc.nasa.gov/content/cloud-architecture-overview